

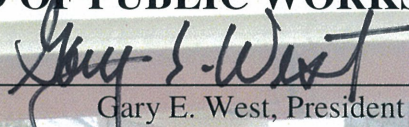


# CITY OF MISHAWAKA INDIANA

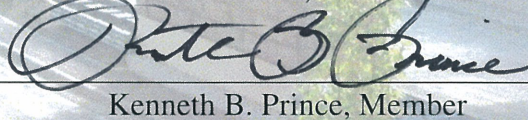
DAVID A. WOOD, MAYOR

## ENGINEERING STANDARDS SPECIFICATIONS & DRAWINGS

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Revision Date

Adopted: April 24, 2007  
Previous Revision: February 12, 2008

# 2013





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## **STANDARD SPECIFICATIONS**

### **SECTION I – GENERAL NOTES AND CONDITIONS**

#### **I-1 PREVAILING SPECIFICATIONS**

- A. The City of Mishawaka Engineering Standards shall consist of these standard specifications and of the City of Mishawaka Standard Drawings, the current issue of the Indiana Department of Transportation Standard Specifications, the current issue of the Indiana Department of Transportation's Standard Drawings, and the current issue of the Indiana Manual on Uniform Traffic Control Devices for Streets and Highways. In the event of any conflict between the City of Mishawaka Engineering Standards and any other documents, the City of Mishawaka Engineering Standards shall prevail.

#### **I-2 DEFINITIONS**

Whenever the following abbreviations and terms appear, the intent and meaning shall be interpreted as provided under this Section.

- A. AASHTO: Shall mean the “American Association of State Highway and Transportation Officials.”
- B. IAC: Indiana Administrative Code
- C. ANSI: Shall mean the “American National Standards Institute.”
- D. ASTM: Shall mean the “American Society for Testing and Materials.”
- E. AWWA: Shall mean the “American Water Works Association.”
- F. City: Shall mean the City of Mishawaka and/or designee as assigned by the issuing/permitting authority.
- G. Department of Engineering: Shall mean the Director of Engineering or any representative of the Department of Engineering.
- H. Director: Shall mean the Board of Public Works and Safety or any representative of the Board of Public Works and Safety.
- I. Emergency: Shall mean any event which may threaten public health or safety, including, but not limited to, damaged or leaking water or gas conduit systems, damaged, plugged, or leaking sewer or storm drain conduit systems, damaged underground electrical and communications facilities, or downed overhead pole structures.
- J. Engineer: Shall mean the City Engineer, the Director of Engineering or a designated representative.
- K. Excavate: Shall mean to dig into or in any way remove or physically disturb or penetrate any part of a Right-of-Way.
- L. Facility or Facilities: Shall mean any infrastructure component or tangible asset in the Right-of-Way required to provide utility service or means of transportation.

- M. High Volume/Major Thoroughfare: Shall mean any street or road meeting ANY of the following criteria:
1. Traffic volume in excess of 5,000 VPD.
  2. Pavement width in excess of 38 feet.
  3. Number of lanes in excess of 2.
  4. Right-of-Way width 60 feet or greater.
  5. Special circumstances temporarily requiring major thoroughfare designation by the City (i.e., major construction along roadway, seasonal or special event, etc.)
- N. IDEM: Shall mean the Indiana Department of Environmental Management.
- O. INDOT: Shall mean the Indiana Department of Transportation.
- P. Bonded Excavator: Shall mean any person who has submitted a Bond to the City to excavate in public places.
- Q. MUTCD: Shall mean the Indiana Manual on Uniform Traffic Control Devices for Streets and Highways.
- R. NEMA: Shall mean the “National Electrical Manufacturers’ Association.”
- S. Newly constructed, reconstructed, or rehabilitated streets: Shall mean any street that has been newly constructed, reconstructed, or rehabilitated within the past 5 years.
- T. OSHA: Shall mean the “Occupational Safety and Health Administration.”
- U. Permittee: Shall mean a person who has obtained a permit as required by this ordinance.
- V. Person: Shall mean any natural or corporate Person, business association or other business entity including, but not limited to, a partnership, a sole proprietorship, a political subdivision, a public or private agency of any kind, a utility, a successor or assign of any of the foregoing, or any other legal entity.
- W. Pole Placement: Shall mean any excavation associated solely with a single placement or replacement of a utility pole.
- X. Professional Engineer: Shall mean an engineer licensed and certified in the State of Indiana by the Indiana Professional Licensing Agency.
- Y. Public Place: Shall mean any public street, way, place, alley sidewalk, park, square, plaza, or any other similar public property owned or controlled by the City and dedicated to public use, and any dedicated-but-unaccepted street or way.
- Z. Rehabilitation: Shall mean that activity of work on any street that provides structural improvement having a minimum service life of 10 years with minor maintenance, which includes pavement overlay of 1.5 inches minimum depth, and partial or full depth reconstruction.
- AA. Right-of-Way: Shall mean the area on, below, or above a public roadway, highway, street, bicycle lane, and public sidewalk in which the City has an interest, including other dedicated Rights-of-Way for travel purposes and utility easements of the City. A Right-of-Way does not include the airwaves above a Right-of-Way with regard to cellular or other non-wire telecommunications or broadcast service.

- BB. Right-of-Way Occupancy Permit: A Right-of-Way Occupancy Permit shall be obtained from the Department of Engineering for any work completed within the right-of-way. This shall include but not be limited to the following: any type of excavation work, repair work on utilities both above and below grade, any work that requires any disruption to normal traffic flow, maintenance of traffic or lane closures.
- CC. Rules & Regulations: Shall mean the Department of Engineering, through the Board of Public Works and Safety, shall establish rules & regulations governing street excavations and implementing this ordinance. The Director may delegate any or all of the duties hereunder.
- DD. Standards: Shall mean the City of Mishawaka Engineering Standard Specifications and Standard Drawings.
- EE. Substructure: Shall mean the Department of Engineering, through the Board of Public Works and Safety, shall establish rules & regulations governing street excavations and implementing this ordinance. The Director may delegate any or all of the duties hereunder.
- FF. Utility: Shall mean a public utility as defined in IC 8-1-2-1 and as it may be hereinafter amended and shall specifically include the non-regulated activities of such a utility.
- GG. Utility Location: Shall refer to the “Indiana Underground Plant Protection Service” commonly known as “Holey Moley.”

### I-3 AS-BUILT DRAWINGS

- A. "As Built Drawings" will be required on all improvements that are to be dedicated to and accepted by the City for inclusion in the public infrastructure; or will in any way impact any part of the existing public infrastructure.
- B. “As Built” or record drawings of any sewer construction, sanitary or storm, in the City of Mishawaka shall be provided to the Department of Engineering upon completion of and prior to the City’s acceptance of the project. As-built drawings shall be submitted on plan and profile sheets in digital format (AutoCAD), as well as typical hard copies. Two hard copies and one electronic copy on CD (with AutoCAD, PDF and TIF formats) shall be submitted.
- C. Requirements for “As-Built” or record drawings:
  - 1. Each as-built sheet must be signed and sealed by a Professional Engineer licensed in the State of Indiana.
  - 2. All elevations shall be in the NAVD 88 (North American Vertical Datum) vertical datum.
  - 3. Indicate the invert and casting elevations of all structures, i.e., manholes, catch basins, inlets, outfalls, etc. Casting elevations on catch basins and inlets will be shown at the flowline.
  - 4. Indicate the percent of line slope between structures and/or between structures and stubs.

5. Indicate horizontal location of sanitary laterals and/or taps from the downstream manhole. See Sewer Tap As-Built Detail, I-2, of these Engineering Standards.
6. Indicate the length of the sanitary laterals and/or taps from mainline sewer including the elevation of the laterals at the property/right-of-way line and offsets if necessary. See Sewer Tap As-Built Detail, I-2, of these Engineering Standards.
7. Indicate the location of all structures i.e., manholes, catch basins, inlets, etc., by stationing.
8. At the completion of construction, the Contractor shall request from the Department of Engineering, in writing, a series of structure numbers to assign to the new constructed sewer structures. The number of installed sanitary manholes, storm manholes, combined sewer manholes, inlets, catch basins, dry wells, storm outfalls, and force main air release valves shall be specified in the request. The City will provide the list of Mishawaka Structure Numbers within five (5) days of the written request. The Contractor shall label each constructed structure with a Mishawaka 'number' for inclusion in the AutoCAD conversion.
9. All structures, i.e., manholes, catch basins, inlets, and outfalls shall also be located by Indiana State Plane; East Zone (NAD83) coordinates.
  - a. This can be done either by GPS (Global Positioning System) or by traditional survey methods with a horizontal accuracy of  $\pm 3$  U.S. survey feet.
  - b. Location of manholes shall be the center of the manhole, casting locations for catch basins and inlets shall be at the flowline.
  - c. Coordinate information shall include ties to two known control monuments. Information for the City base station can be provided upon request.
10. As-built drawings shall indicate the locations of other existing utilities, including but not limited to communications and signals, fiberoptic, telephone, electric and water.
11. As-built drawings shall show all right-of way, easement and property lines. When service taps have been installed, all property information shall be shown (i.e., lot #, address, property owner name).
12. Place a check mark (✓) on the profile section of the sheet next to structure callouts, invert elevations, and/or line slope information that are installed per plan, e.g.:

✓ MH #1 STA 1+00/10' RT, Line 'M'  
✓ 360 LFT – 30" sanitary sewer @ 1.00 percent

13. Any changes on horizontal and vertical location of sewers and any changes on percent of line slope must be shown on plan and profile sections.



14. Any revisions on the plans shall be noted and the area shall be bubbled, referenced to the revision table as an “As-Built” revision, and dated accordingly.
15. All information on “As-Built” or record drawings that are kept in the field or project site must be neat, concise, and legible. All the as-built information shall then be converted onto the drawings in a digital AutoCAD format.
16. Indicate the composition of pipe, i.e., Clay, RCP, DIP, etc., on profile section of sheet for each run. A “run” being a section of pipe between structures or between structures and stubs.
17. Any other information or data requested by the Department of Engineering personnel must be submitted if requested.
18. The final “as-built” or record drawings shall have a designated area on each sheet for the Contractor to place their certification including the seal and signature of a Professional Engineer licensed in the State of Indiana. The following is an example of an “As-Built” certification:

#### **AS-BUILT DRAWINGS**

I HEREBY CERTIFY THAT TO THE BEST OF MY KNOWLEDGE AND BELIEF THAT THESE AS-BUILT RECORD DRAWINGS REPRESENT THE CONSTRUCTION IMPROVEMENTS AND UTILITY INSTALLATIONS COMPLETED FOR THE PROJECT.

CONTRACTOR  
ADDRESS  
CITY, ST ZIP  
PHONE

(STAMP HERE)

(SIGNATURE HERE) (DATE)  
REGISTERED PROFESSIONAL ENGINEER

- D. All projects contracted with the City of Mishawaka shall require the Contractor to have the “as-built” or record drawings digitally drafted by the design engineer or consultant for the project. The costs associated with the digital conversion shall be paid to the design engineer or consultant by the Contractor.

#### **I-4 BOND REQUIREMENTS**

- A. Public Works Bond is required for construction in the public right-of-way, which is posted to the office of the Department of Engineering. This Bond is a calendar year bond and is the contractor’s responsibility to provide continuations from year to year. This Bond is required to be current in order to obtain City permit to perform any excavation, or other work, in the public rights-of-way of the City.
- B. Maintenance Bond shall be provided by the Contractor that binds themselves to the City for the guarantee of the work, material, and conditions of the work completed for any improvements that are to be accepted by the City. The Maintenance Bond amount shall be 10 percent of the construction value or \$25,000, whichever is greater. The Maintenance Bond shall be provided for a period of 3 years, from the date of acceptance of such improvements.

- C. Provide all required bonds, per the project specifications, for any work that is completed under contract with the City.

#### I-5 PERMITS

- A. Permit fees are as set forth in the current City Code of Ordinances.
- B. Obtaining and protecting utility locations are the sole responsibility of the Contractor.
- C. Only licensed and bonded Contractors (Public Works Bond) shall be eligible to obtain a permit to perform any excavation, or other work, in the public rights-of-way of the City.
- D. A Sewer Construction Permit shall be obtained from the office of the Department of Engineering prior to any work associated with the sewer. The sewer work shall include but not be limited to the following: any type of sewer excavation work, new sewer construction or connections, existing sewer repair work and sewer manhole connection or repair work.
- E. A Right-of Way Occupancy Permit shall be obtained from the office of the Department of Engineering prior to any type of work within a City street or right-of-way. Work within the right-of-way that requires a Right-of-Way Occupancy permit shall include but not be limited to the following: any type of excavation work, repair work on utilities both above and below grade, sidewalk or driveway repair or replacement, major landscaping (including, but not limited to, retaining walls, tree plantings, and walkways) within or adjoining the right of way or parkway, any work that requires any disruption to normal traffic flow, maintenance of traffic or lane closures. In accordance with the City Ordinance a drawing(s) indicating all pertinent information regarding the work to be done (location, purpose, work area, trench width, length and depth, barricades, traffic maintenance plan, duration of work, etc.) shall be submitted to obtain such permit.
- F. Numerous arterial streets in the City are designated as "High Volume Streets" and require a "High Volume Street Cut Permit." A detailed drawing(s), as in item D, above, must be submitted, with particularly close attention to traffic safety and maintenance, to obtain this permit. Three working days are to be allowed for the processing of this permit.
- G. Any work on a state Highway, or within State rights-of-way, requires a permit from the Indiana Department of Transportation Permits Department of the LaPorte District office. Please call (219) 362-6125 for more information.
- H. The construction of any new driveway or connection with any City street requires a driveway permit from the office of the Department of Engineering. A Detailed Drawing indicating location of the driveway (distance from any intersection and existing driveways, adjacent and opposite) tapers or radii, the existing and proposed elevations and any other information necessary to properly show the proposed work is to be included on the drawing and become part of the permit.

- I. Comply with all federal, state, and local statutes, rules, regulations, and ordinances related to the proposed work. Obtain any Environmental permits deemed necessary including, but not limited to the following.
  - 1. IDEM Construction/Land Disturbance Storm Water Permit (327 IAC 15-5, Rule 5).
  - 2. IDEM permit.
  - 3. IDNR permit.
  - 4. Army Corps of Engineers
- J. Obtain any permit required for storm water run-off associated with construction activity and develop, implement and maintain a storm water management plan consistent with the requirements of 327 IAC 15-5. Obtain a local erosion control permit and submit erosion control plan, if required, in accordance with City ordinance and Section I-12.
- K. Any work on or near City streets requires a Maintenance of Traffic plan consistent with the requirements of Section VIII-2.
- L. Any work within railroad right-of-way shall be in accordance with the specifications and requirements of the railroad having jurisdiction. The Contractor is responsible for coordinating with the railroad and must have all applicable railroad permits approved prior to performing work.

#### I-6 SAFETY REQUIREMENTS

- A. Comply with all federal, state, and local codes and regulations.
- B. Contractor shall have notices posted in prominent locations showing emergency telephone numbers etc., as required by law.
- C. Provide temporary fire extinguishers as required by law.
- D. Provide first-aid kit as required by law.
- E. Contractor shall be responsible for all protection of persons and property in the construction area.
- F. Contractor shall follow all OSHA regulations.
- G. If required, a Health and Safety Plan shall be submitted and on file with the City.

#### I-7 CLEARING OF RIGHT-OF-WAY OR EASEMENTS

- A. Clearing of Right-of-Way or Easements shall consist of clearing, grubbing, removing, and disposal of all vegetation and debris within the limits of the Right-of-Way or Easement. Burning is not permitted.
- B. All existing trees and vegetation that are noted as to remain shall be protected.
- C. Any damage to the natural habitat, vegetation, or objects designated to remain shall be repaired, replaced, or compensated for by the Contractor for no additional payment.

- D. Contractor shall obtain approval from the City of Mishawaka prior to the cleaning, removal and disposal of any objects within the right-of-way unless noted as such.
- E. Topsoil Stripping and Stockpiling
  - 1. Stockpile topsoil in areas that are approved by the City of Mishawaka.
  - 2. Dispose of unsuitable or excess topsoil per all local, State and Federal regulations.
  - 3. Provide erosion-control measures for all stockpile areas to prevent soil erosion and discharge of soil bearing water runoff to adjacent properties and walkways.

#### I-8 EXCAVATION

- A. Emergency Excavation - The office of the Department of Engineering is to be notified as soon as possible in the event of any emergency excavation, followed by a permit application.
- B. Initial Excavation
  - 1. The Contractor is responsible for the placement of all safety lighting, barricades, and warning signs.
  - 2. Initial access hole shall be cut only as large as required to perform work.
- C. Any excavation undertaken or authorized by this ordinance shall comply with all the requirements per the Indiana Code.

#### I-9 COMPACTION REQUIREMENTS

- A. The minimum soil compaction requirements for backfill material and pavement subgrade will be as indicated below. The moisture content shall be controlled within -2 and +1 percentage points of optimum moisture content. Maximum density and optimum moisture content shall be determined in accordance with the standard Proctor test ASTM D-698 and AASHTO T 99 using method A for soil and method C for granular materials.

Subgrade under pavement and curbs	100%
Topsoil used in all but the top six inches (6") of fill	90%
Existing ground receiving fills.	95%
Backfill in pipe and conduit trenches under pavements and curbs.	95%
All other areas receiving fill.	95%

**B. Compaction Testing Frequency**

1. A minimum of one compaction test will be required on the backfill for each sewer pipe and water main pipe transverse run that is under the pavement or concrete curb. A minimum of three compaction tests will be required on the backfill for sewer pipe or water main pipe run. A pipe run is the length between structures or valves.
2. A minimum of one compaction test will be required per 500 square yards of roadway, per lift of earth fill or subgrade. The minimum number of tests is 10 each.
3. Location of the compaction tests will be selected by the Department of Engineering.

**I-10 PROTECTION OF EXISTING UTILITIES**

- A. Protect existing utilities during construction.
- B. Notify the City of Mishawaka and their representatives not less than two days in advance of any proposed utility interruptions.
- C. Contact Indiana Underground Plant Protection Service (IUPPS) at 1-800-382-5544 for utility location services for the construction project area a minimum of three working days prior to any excavation. This does not relieve the Contractor of notifying utility owners who may not be part of the IUPPS alert system.
- D. Demolish and remove completely any underground utilities indicated to be removed. Coordinate with the utility companies to shut off services if lines are active.

**I-11 TRENCHING LIMITS**

- A. Excavate trenches to indicated gradients, lines, depths, and elevations, as noted on the plans.
- B. Excavate trenches to allowable widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
- C. Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

**I-12 EROSION CONTROL**

- A. Erosion and Sediment Control is required for all work. It shall be the responsibility of the Contractor during construction to prevent sediment in storm water runoff from leaving the construction site.



- B. The Contractor shall be responsible to comply with all aspects of the City of Mishawaka's "Erosion Control Ordinance" including permitting and bonding as required.
- C. The erosion control permitting measures contained herein do not relieve the Contractor from compliance with all aspects of 327 IAC 15-5, Rule 5 IDEM Construction/Land Disturbance Storm Water Permitting.
- D. All erosion and sediment control measures provided should follow the recommendations provided in the "Indiana Storm Water Quality Manual – Planning and Specification Guide for Effective Erosion and Sediment Control and Post-Construction Water Quality" available from IDEM, published October 2007, and any supplements thereto.
- E. Self-monitoring should be conducted per 327 IAC 15-5. Self-monitoring program should include written evaluation of the project site by the end of the next business day following each measurable storm event and at minimum one time per week. Evaluations should address maintenance of existing storm water quality measures to ensure proper function, identify any additional measures necessary to remain in compliance, and provide details of corrective actions recommended and completed. Evaluations should be available to inspecting authority within forty-eight hours of a request.

#### I-13 DVD RECORD AND PHOTO JOURNAL

- A. Any work completed within the City Right-of-Way may require a video record and/or photo journal. Contact the Department of Engineering to determine if a video record or photo journal is required. All work contracted with and completed for the City will require a video record and photo journal.
- B. All work to complete the video record and the photo journal shall be completed by a professional photographer/videographer. Any submitted video or photography that lacks professional quality will be required to be re-shot using a business that specializes in construction documentary video/photography.
- C. One original and one copy of both the DVD and the Photo Journal shall be forwarded to the Department of Engineering for review prior to beginning construction and shall become the property of the City.
- D. All DVD's shall be labeled with the name "City of Mishawaka" and the name of the Contractor. The photo journal shall be in color and professionally labeled showing the name "City of Mishawaka" and the name of the Contractor.
- E. The Contractor shall keep one copy of both the DVD and the Photo Journal for their records.

- F. The Video Record shall be submitted in a DVD format, professionally completed video recording of the entire project area to clearly show all features located within and adjacent to the right-of-way. This includes driveways, sidewalks, street pavements, nearby building foundations, retaining walls, landscaping, encroachments in the right-of-way, shrubs, trees, fences, etc., prior to the start of construction. The DVD shall include close-ups of the foundations of each structure located adjacent to the right-of-way. The DVD shall cover three sides of the foundation, the side adjacent to the right-of-way and the two sides perpendicular to the right-of-way. Audio identification shall be included to describe each property, i.e., “You are seeing 200 E. Main Street the east side of the property” also every effort shall be taken to give some visual reference of each shot (panning to an address or street sign). The camera work must be reasonably stable (the use of a tripod may be necessary). The recording shall include a time and date code displayed at one corner of the screen.
- G. The Photo Journal shall be made of as many pictures as necessary to clearly show all visible cracks, foundation faults, and sidewalk and driveway cracks of each adjacent property. A minimum of 1 picture shall be provided for each of the 3 sides of the structure or foundation to show the existing condition. All fences, trees and landscaping shall be included in at least 1 of the photos. Photographs shall be made with a digital camera with at least 6 megapixels. Photographs shall be in color, 8 inch x 10 inch with a tape or scale to provide registration of photograph for any existing damage. Photographs shall be taken in sufficient lighting to provide high quality details. Photographs shall include the date taken in one corner and an address or location identifier label. The photos for a specific address and location shall be in its own folder.
- H. If any existing conditions, abnormalities, or defects exist prior to construction they shall be well documented. Documentation may require conclusive visual evidence (i.e., physical measurement of an existing crack in video record or photograph).

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## SECTION II – APPROACHES

### II-1 NEW DRIVE CONSTRUCTION

- A. All new and reconstructed drives shall comply with Standard Specification Section IV-1 Preparation of Subgrade and IV-3 Concrete Pavements.
- B. Construct driveway per Standard Drawings II-1, II-1A, II-4, II-4A, II-5, and II-6.
- C. The minimum and maximum width of driveways shall comply with Standard Drawings II-4 through II-6.
- D. New drives constructed in areas of existing roads with curb and gutter are required to maintain the existing gutter line through the limits of the drive by depressing the existing curb, as shown in standard detail II-1A. The gutter should run continuously through the drive approach.
- E. In areas of new road construction, depressed curb shall be installed through the limits of all drives, as shown in standard detail II-1A. The gutter should run continuously through the drive approach.
- F. Expansion and contraction joints are required.

### II-2 GRADE CONTROL

- A. Grade control shall be set by one of the following methods:
  - 1. Using a string line, set grade stakes at a minimum of 25 feet on center.
  - 2. Using a laser, set grade stakes at every grade break.
- B. Provide additional control to insure forms are placed such that positive drainage by gravity flow will be obtained.

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## SECTION III – CURBS, CURB RAMPS, AND SIDEWALK

### III-1 CURB AND GUTTER

- A. Backfilling
  - 1. Shall not begin until after concrete has cured for 72 hours.
  - 2. Shall match the surrounding grade and be reseeded or sodded.
- B. Contractor must remove any damaged section of curb to the nearest joint.
- C. Drainage outlets such as roof drains or underdrains are prohibited at the curb.
- D. Restoration of street pavement areas damaged by curb removal shall be restored to the existing material and thickness.

### III-2 CURB RAMPS

- A. Concrete curb ramps, including flared side and rolled edges where used, shall be 6 inch concrete. All work and materials related to the construction of curb ramps shall be in accordance with the current INDOT Standards Specifications.
- B. Curb ramps located at intersections shall be constructed in accordance with the Mishawaka Standard Drawings, or the Americans with Disability Act of 1990 (and any supplements thereto)(ADA), whichever is more restrictive.
- C. Detectable warning panels shall be installed for any new construction or reconstruction of curb ramps where the curb ramp, landing, or blended transition connects to a street. Curb ramps located at any other location other than intersections (such as at driveways) shall be constructed per Standard Drawings without detectable warning panels.
- D. Detectable warning panels shall be manufactured by Armor Tile from an epoxy polymer composite material meeting a compressive strength of 28,800 psi, in accordance with ASTM D 695-02a, or approved equal and shall be installed in accordance with the manufacturer's recommendations. The acceptable colors for detectable warning panels will include:
  - 1. Colonial Red (Federal Color No. 20109)
  - 2. Or other visually contrasting color as approved by the Department of Engineering.
- E. The detectable warning surface shall be located so that the distance to the near edge of the curb line is 6 inch minimum and 8 inch maximum and shall extend 24 inch minimum in the direction of travel. Detectable warning surface shall extend the full width of the curb ramp exclusive of flares.
- F. Drainage inlets shall be located uphill from curb ramps to prevent water ponding at the path of travel.
- G. The bottom edge of the curb ramp shall be flush with the edge of the adjacent pavement.

- H. Landing areas at the top of curb ramps shall have a maximum cross slope of 50:1 in any direction. When site infeasibility precludes construction of a landing area of 50:1 in any direction, the slope perpendicular to the curb face shall not exceed 50:1.
- I. Minimum width of curb ramp is 4 feet-0 inches per current ADA/ABA standards.
- J. Grooves are to be placed behind the detectable warning panel in, accordance with the Standard Drawings. Grooves may not exceed ½ inch width or depth.
- K. No mid-block ramps are permitted.
- L. Gratings, access covers, and other appurtenances shall not be located on curb ramps, landings, or blended transitions.
- M. All curb ramps shall require detailed spot elevation plans to verify compliance with accessibility requirements.

### III-3 SIDEWALK

- A. Expansion joints are required at intervals not to exceed 50 feet for 5 feet sidewalk.
- B. Specify placement of expansion joints for sidewalk around utility poles, which may project out into the sidewalk, around hydrants and manhole frames, walls, and between sidewalk and buildings abutting said sidewalk.
- C. Where sidewalk is being replaced, sawcut and join the walk to the nearest joint of the existing improvements. If existing adjacent concrete slabs not scheduled for replacement are damaged by the Contractor's operation, the Contractor shall replace the concrete to the next joint at no cost to City. Repair or removal of any panel of sidewalk shall be removed to the nearest joint regardless of property line.

### III-4 MISCELLANEOUS CONCRETE

- A. All work and materials related to the construction of driveways, sidewalks, curb and gutter, and curbing are to be in accordance with the current Indiana Department of Transportation Standards Specifications.

## SECTION IV - PAVEMENT

### IV-1 PREPARATION OF SUBGRADE

- A. The subgrade shall be shaped to the required grade and sections, free from all ruts, corrugations, or other irregularities, and uniformly compacted and approved in accordance with Section 207 of the INDOT Standard Specifications.
- B. Surfaces on which a mixture is placed shall be free from objectionable or foreign materials at the time of placement.
- C. If unsuitable soils are encountered, they shall be addressed in accordance with Section 203.05 and 203.16 of the INDOT Standard Specifications or as required by the City Engineer.
- D. Preparation of subgrade shall be in accordance with Standard Specifications section I-8 and I-9.

### IV-2 ASPHALT PAVEMENTS

- A. All materials are to be in accordance with the current Indiana Department of Transportation Standards Specifications: Section 402.
- B. The contractor shall submit a job mix formula for approval 5 working days prior to any mix placed. The contractor will not be allowed to proceed with the placement of asphalt without an approved job mix formula. The contractor shall notify the city 48 hours prior to placing any asphalt.
- C. The HMA shall be supplied from a certified HMA plant in accordance with ITM 583 - Certified Volumetric Hot Mix Asphalt Producer Program. The HMA shall be transported and placed in accordance with the current Indiana department of Transportation Standards Specifications: Section 402.
- D. If the Engineer requests pavement cores, the Contractor shall, within one workday, clean, dry, and refill the core holes in accordance with Standard Specification Section IV-4-A Bore hole Restoration.

### IV-3 CONCRETE PAVEMENTS

- A. All materials are to be in accordance with the current Indiana Department of Transportation Standards Specifications.
- B. Fly Ash May Be Used in Concrete Mix in Accordance With Sections 702.05 and 901.02 of The Indiana Department of Transportation Standard Specifications.
- C. Pavement joints shall be in accordance with the current Indiana Department of Transportation Standard Specifications.
- D. Cold Weather Concrete Protection
  - 1. Contractor will assume full responsibility for placing concrete and for all damage caused by freezing.
  - 2. Do not place concrete on frozen materials.

3. When air temperature is at or below 40 degrees Fahrenheit and decreasing placement of concrete shall be discontinued, and cannot begin again until the air temperature has reached 35 degrees Fahrenheit and is rising.
  4. The contractor shall provide the necessary equipment and materials to prevent the concrete from freezing prior to attaining opening to traffic strengths, in accordance with INDOT Standard Specification 502.11.
- E. Protection
1. Protect concrete work against injury from elements and defacement of any nature, including vandalism during construction operations.
  2. Provide protection of placed concrete from vandalism, wind, temperature extremes, and loss of moisture.
  3. Do not permit concrete to freeze. Protect by covering with insulated blankets.
  4. Remove and replace any damaged concrete as directed by the Engineer.
- F. Immediately after the finishing operations, the entire surface of the newly placed concrete shall be covered and cured in accordance with INDOT Standard Specification section 504.04. Usually a white pigmented curing compound is utilized and is preferred by the City.
- G. Utilize signs, barricades, flag persons or any other equipment and personnel to make safe construction areas within the City right-of-way, in conformance with current MUTCD standards.
- H. Removals
1. All excavated areas shall be protected at all times.
  2. Disposal of debris resulting from clearing or removal operations shall be removed from site immediately to an off-site area.
  3. No stockpiling or on site containers will be allowed.
- I. If the Engineer requests pavement cores, the Contractor shall, within one workday, clean, dry, and refill the core holes in accordance with Standard Specification Section IV-4-A Bore hole Restoration.

#### IV-4 PAVED STREET PATCHING

- A. Bore Hole Restoration
1. All bore holes made in existing pavement for soil investigation or pavement coring shall be restored in accordance with Standard Detail IV-2A
- B. Temporary Patch
1. If conditions do not allow the placement of a permanent concrete patch, a temporary asphalt patch shall be allowed. Temporary Patches Shall Be a Minimum Depth of 4 inch For Local and Collector Streets and a Minimum Depth of 8 inch for Arterial Streets.

2. When a temporary patch is to be in place for more than 24 hours the permittee shall furnish the office of the Department of Engineering with the name and phone number of the party responsible for after hours maintenance.

C. Flowable Backfill

1. Shall be a workable mixture with the following properties:

Minimum Unconfined Compressive Strength at 28 days	50 psi
Maximum Unconfined Compressive Strength at 28 days	150 psi
Minimum Fill Spread Diameter at time of placement	8 inches

2. Flowable Backfill shall not be subject to load nor disturbed by construction activities until the penetration resistance testing, in accordance with INDIANA TEST METHOD (ITM) 213, meets the following requirements:

Concrete Pavement	70 psi
All Other Applications	1200 psi

3. Do not place on frozen ground.
4. Protect from freezing until material has set.
5. Do not place into or through standing water, unless approved by the Engineer.
6. Properly attach or anchor all parts and materials that are to remain in the excavation to prevent objects from floating.

D. Weather Limitations

1. Unless special permission is obtained, no permanent patches shall be placed between November 1 and April 1. During these periods, a durable temporary patch shall be placed in the original access hole.
2. The maintenance of this temporary patch shall be the sole responsibility of the permittee. The permittee shall provide the office of the Department of Engineering with the name and telephone number of the party responsible for the maintenance of the patch.

E. Permanent Patch Installation

1. If concrete is used as a patch in an area of existing asphalt pavement, the concrete shall be integral dyed with Lamp Black Dye.
2. Concrete patches will be placed 8 inches thick, or to a depth to match the existing pavement, whichever is greater.
3. Any patches placed on high volume or major arterial roads shall be a minimum of 10 inches thick, or to a depth to match the existing pavement, whichever is greater.
4. Refer to standard detail sheets IV-2 and IV-3 for more information.



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## SECTION V – SANITARY SEWERS

### V-1 SANITARY SEWER PIPE MATERIALS

- A. Sanitary Sewer (Non-Pressure Gravity Sewer) shall be one of the following:
1. Vitrified Clay - ASTM C700 (with City approval only)
  2. PVC (Polyvinyl Chloride) - ASTM D-3034 for SDR 35 and SDR 26 for 15 inch diameter and smaller pipe. ASTM F-679, for PS 46 and 115 for pipe larger than 15 inches diameter. Joints and Fittings shall conform to ASTM D-3212 or ASTM D-2464. Gaskets shall be reinforced with a steel ring and conform to ASTM F477.
  3. Ductile Iron Pipe ASTM A746, with cement lining per AWWA C104.
- B. Sanitary Sewer shall meet the following for depth of bury:

SANITARY SEWER GRAVITY PIPE

Depth (Feet)	Ductile Iron Pipe (Pressure Class)	PVC (4 inch-15 inch) (SDR)		PVC (18 inch-36 inch) (PS)	
	350	35	26	46	115
5 - 10	X	X			
10 - 14	X	X			
15 - 19	X		X	X	X
20 - 24	X				

### V-2 SANITARY SEWER GRAVITY PIPE INSTALLATION

- A. All sanitary sewers shall be designed and installed in accordance with the “Recommended Standards for Wastewater Facilities” by the Great Lakes Upper Mississippi River Board of State and Provincial Health and Environmental Managers. All sanitary sewer extensions shall be approved by the Indiana Department of Environmental Management and the City of Mishawaka, Board of Public Works and Safety.
- B. All sewer pipes shall be laid using a laser beam method to control alignment. All sewer pipes shall be laid true to both horizontal and vertical alignment, and will be subject to review by the Department of Engineering. Pipes that do not “Lamp” shall be removed and reinstalled to true line and grade.
- C. Commence laying gravity sewer pipe at the lowest point on a section of line and lay pipe with the bell ends uphill.
- D. New pipe must match the pipe to which it is being connected. All of the pipes herein permitted shall be connected to a concrete manhole.
- E. Prior to making connections at pipe joints and manholes, remove all mud, sand or other foreign material then clean and dry all surfaces of pipe joints and joining material. Use materials as recommended by the manufacturer.

- F. Follow the IDEM standards for separation of sanitary sewer and water distribution systems. If the minimum separation cannot be met then the sanitary sewer pipe material shall be an AWWA approved pressure grade water pipe of ductile iron with mechanical joints or PVC-C900 or PVC-C905 with compression seals. The pipe shall be pressure tested in place at 150 psi without leakage.
- G. A permanent video inspection, of any sanitary sewer constructed in the City or connected to the City's sewer system, shall be conducted by the City of Mishawaka's Sewer Maintenance Department. All video recording shall be completed by the City upon the submittal and approval of the as-built drawings. Contractor shall coordinate and be responsible for all costs associated with the video inspection completed by the City.
- H. The Contractor, upon completion of installation of the sewer, shall give written notification to the Department of Engineering.
- I. The office of the Department of Engineering shall be notified at least 48 hours in advance of any testing, in order to be able to witness the tests. Tests for sanitary sewers shall include but not be limited to infiltration, exfiltration, deflection, and manhole vacuum.
- J. Sanitary sewer service laterals shall be installed per Section V-11 of these specifications.
- K. Installation of all PVC sanitary sewer pipe shall conform to ASTM D2321.
- L. Underground detectable warning tape shall be placed above the sanitary sewer approximately 2 feet below finished grade. Tape to be 2 inch wide metallic lined with the wording "CAUTION SEWER LINE BURIED BELOW" continuously printed.
- M. The installation of sanitary sewer pipe, within a casing, by jack/bore method shall be per Section VII-2.

### V-3 SANITARY SEWER TESTING

- A. The Contractor may perform either an exfiltration test with water or a low-pressure air test.
- B. Maximum allowable infiltration/exfiltration rate is 100 gallons per inch diameter per mile of sewer per day. Manholes, if tested separately, shall have a maximum allowable infiltration/exfiltration rate of 0.1 gallons per hour per foot of diameter per foot of head.
- C. All sanitary sewer piping that is subject to a low-pressure air test shall be as follows: Vitrified Clay Pipe (VCP) and Ductile Iron Pipe shall be tested in accordance with ASTM C 828-03; Plastic piping shall be tested in accordance with ASTM F1417-92. The test shall be witnessed and certified by a Professional Engineer licensed in the State of Indiana and submitted to the office of the Department of Engineering.
- D. When the normal water table is above the sewer throughout the section under test, the Contractor may, with approval from the Engineer, use the infiltration test procedure.

- E. All flexible sewer piping shall be subject to deflection testing. The maximum acceptable pipe deflection after installation is 5 percent of the nominal pipe diameter. The pipe shall be tested by the contractor 30 days or greater after the installation is complete and prior to permanent pavement placement. The deflection test shall be completed with a 9-point mandrel for maximum deflection. The mandrel shall be pulled manually and no force pull on the mandrel will be permitted. The deflection test shall be witnessed and certified by a Professional Engineer and submitted to the office of the Department of Engineering. The Contractor shall provide the Engineer with a proving ring to verify the mandrel size. If the pipe fails the deflection test, the pipe shall be excavated, removed, and discarded. New pipe shall be installed and retested per the above.
- F. All non-rigid sewers to be stiffness certified. The pipe stiffness shall be a minimum of 46 psi.
- G. The office of the Department of Engineering shall be notified 48 hours in advance of any testing in order to have the option of witnessing the test. If witnessed by the City or their representative, they shall sign the testing documents the day of the test.

#### V-4 SANITARY SEWER MANHOLES

- A. Manholes shall be constructed per the Standard Drawings for the type and size shown on the drawings.
- B. Manhole frame and lid shall be a Neenah R-1741-D or approved equal. Use a Mishawaka Manhole Lid, Detail V-7, if designated by the City. A 24 inch frame and lid will only be allowed with approval from the Department of Engineering, See Detail V-6.
- C. Manholes shall be constructed per ASTM C478 with joints meeting requirements of ASTM C443.
- D. New manholes shall have exposed interior wall and joint sections coated with a corrosion protection system, if designated by the City. The corrosion protection lining shall be installed to a minimum thickness of 125 mils to create a monolithic (void free) liner. The corrosion protection system for new manholes shall be the following:
  - 1. High-build polyurethane coating system with a minimum film thickness of 125 mils. Application of the coating system shall be per the recommendations of the coating manufacturer. Polyurethane coating manufacturer's are Spray Wall as manufactured by Sprayroq, Inc. or approved equal.

#### V-5 SANITARY MANHOLE VACUUM TESTING

- A. The test shall be performed per ASTM C 1244 on all Type A and Type B sanitary manholes.

- B. Furnish, install, and operate all equipment, and materials, including meters, gauges, fuel, bulkheads, water and accessory equipment and all manpower for the test.
- C. The test shall be witnessed and certified by a Professional Engineer and submitted to the office of the Department of Engineering.
- D. If the test fails, the Contractor shall determine the cause, and then repair/replace the manhole to the satisfaction of the Engineer. The test shall be repeated until it is successful.
- E. The office of the Department of Engineering shall be notified 48 hours in advance of any testing in order to have the option of witnessing the test. If witnessed by the City or their representative, they shall sign the testing documents the day of the test.

#### V-6 SANITARY LIFT STATION

- A. The requirements for a sanitary lift station shall not be limited to the following specifications. Contact the Department of Engineering for more detailed specifications and requirements for a sanitary lift station.
- B. Description:
  - 1. Lift Station shall be a factory-built dry pit-wet well type sewage lift station complete with precast concrete wet well and all power and other services.
  - 2. A security fence and access road shall be provided.
  - 3. An exterior electrical panel with a permanent emergency generator with automatic transfer switch shall be provided.
- C. Submittals:
  - 1. The lift station shall not be released for fabrication until reviewed shop drawings and design calculations have been approved and released by the Department of Engineering.
  - 2. Design calculations for the lift stations shall be certified by a registered Professional Engineer.
- D. Products and Installation:
  - 1. The Contractor shall furnish and install one factory-built automatic pumping station. The station shall be complete with all needed equipment factory-installed in a welded steel chamber with welded steel entrance tube and with maintenance lift to provide access. The lift station shall be manufactured by Smith & Loveless, Inc. or approved equal.
  - 2. The principal item of equipment shall include two vertical, close coupled, motor driven, non-clog sewage pumps; valves; internal piping; central control panel with circuit breakers; motors starters; automatic pumping level controls; lighting; sump pump; ventilator; dehumidifier and all internal wiring.

3. The Contractor shall furnish and install a pump control panel mounted within a NEMA Type 1 enclosure, fabricated of steel and reinforced as required. All circuit breakers, motor-starters, reset buttons and pump control switches shall be mounted so that they are operable without opening the high voltage cabinet.
4. The Contractor shall furnish and install a level transducer to control pump operation by the level of the sewage in the wet well. The transducer shall be suspended by a stainless steel cable or a pipe mounted within the wet well. The transducer shall produce a 4-20 mA signal that will feed into the pump controller.
5. The Contractor shall furnish and install a secondary level control system consisting of a Siemens CB1T redundant float control along with 2 floats.
6. The Contractor shall furnish and install a pump controller. The controller shall be a factory installed LC-150 controller by Siemens or approved equal.
7. The Contractor shall furnish and install a Remote Telemetry Unit (RTU) at the lift station. The RTU shall be housed above ground in a NEMA 4X enclosure and shall be a Siemens Series S-216 (or current model), or approved equal.
8. The Contractor shall coordinate the necessary interface contacts between the pump control panel and the telemetry panel with the manufacturers.
9. The Contractor shall provide the lift station with a radio antenna to be installed above grade adjacent to the lift station in a suitable location. The antenna should be mounted per the manufacturer's recommendations as approved by the Department of Engineering. The antenna height shall provide line of sight transmission to a designated location as set by the Department of Engineering.
10. The Contractor will be responsible for the following:
  - a. Modifications to master computer software to accept the new station.
  - b. Establishing stable communication from the lift station to the WWTP master telemetry computer.
  - c. The Contractor shall coordinate the above with Mishawaka Utilities Wastewater Division.
11. The telemetry equipment shall be furnished and installed and shall be integrated with the pump control panel and the LC-150 controller, i.e., 4-20 mA output signals.
12. Substitution of equipment other than that stated will not be accepted without prior approval from the Department of Engineering.

**V-7 SANITARY SEWER FORCEMAIN MATERIALS**

- A. Ductile Iron Pipe – Pipe, fittings, and gaskets shall conform to ANSI/AWWA A21.51/C151, ANSI/AWWA A21.10/C110, and ANSI/AWWA A21.11/C111. The ductile iron pipe and joints for the sanitary forcemain shall be plain joints in straight runs and restrained joints at bends and fittings with thrust blocking. Restrained joints shall conform to American Cast Iron Lok-Ring Joint, U.S. Pipe TR Flex, or equal. The pipe shall be pressure class 350. The Ductile Iron Pipe shall have a cement mortar lining with a bituminous seal coat conforming to the requirements of ANSI/AWWA A21.4/C104
- B. High Density Polyethylene (HDPE) Pipe – The use of HDPE pipe shall be upon Engineer's approval only. HDPE pipe shall conform to ASTM D3350 with a minimum cell classification of PE345464C. The pipe shall have a nominal DIPS (Ductile Iron Pipe Size) OD (Outer Diameter) unless otherwise indicated. The DR (Dimension Ratio) shall be no greater than DR 11 classification. HDPE fittings shall be in accordance with ASTM D 3261. The designer shall determine the pipe thickness required, based on the installation methods and the live and dead loads.

**V-8 SANITARY SEWER FORCEMAIN INSTALLATION**

- A. All sanitary sewers shall be designed and installed in accordance with the "Recommended Standards for Wastewater Facilities" by the Great Lakes Upper Mississippi River Board of State and Provincial Health and Environmental Managers. All sanitary sewer forcemains shall be approved by the Indiana Department of Environmental Management and the City of Mishawaka, Board of Public Works and Safety.
- B. Prior to making connections at pipe joints and manholes, clean and dry all surfaces of pipe joints and joining material. Use materials as recommended by the manufacturer.
- C. Concrete thrust blocking shall be provided at all changes in directions. Concrete thrust blocking anchors shall bear against undisturbed earth. Restrained joints shall be used in combination with concrete thrust blocking. Restrained joints shall be placed at fittings upstream and downstream of the fitting to be anchored.
- D. Follow the IDEM standards for separation of sanitary sewer and water distribution systems.
- E. The Contractor, upon completion of installation of the sewer, shall give written notification to the Department of Engineering.
- F. The office of the Department of Engineering shall be notified at least 48 hours in advance of any testing, in order to be able to witness the tests.

- G. The locations of buried sanitary sewer forcemains shall be identified with either above ground or at grade pipe markers located at a minimum of 400 feet intervals and at all changes in horizontal alignment. Underground detectable tracer wire, Type TW insulated #12, shall be placed above the forcemain and connected to a terminal located within each marker. The tracer wire shall maintain connectivity throughout the length of the forcemain, including at any changes in direction, structures, air release valves, manholes, pipe markers, etc. The markers shall be per Details V-14, V-14A and V-14B in the Standard Drawings.
- H. The installation of sanitary sewer forcemains, within a casing, by jack/bore method shall be per Section VII-2.

#### V-9 SANITARY SEWER FORCEMAIN TESTING

- A. Leakage and Pressure Tests shall be witnessed and certified by a Professional Engineer and submitted to the office of the Department of Engineering. Contractor shall notify the City and the Engineer within 48 hours of testing to allow test to be witnessed.
- B. The Contractor shall be responsible for providing all equipment and tools necessary to perform pressure tests and leakage tests. Tests shall be per the following:
  - 1. Supply water, install and operate the pumps, calibrate gauges and meters and supply all necessary manpower and apparatus for the test.
  - 2. Hydrostatic Pressure Test: After the line has been backfilled and at least 7 days after the last concrete anchor block was poured (if applicable), hydrostatic pressure test shall be performed. Carefully fill the system with water at a velocity of approximately 1 foot per second while necessary measures are taken to eliminate all air. After the system has been filled, raise the pressure by pump to test the greater of 1.5 times the working pressure or 90 psi. Measure pressure at lowest point in system with gauge compensated for elevation. Maintain this pressure for at least 2 hours. If pressure cannot be maintained, determine the cause, repair, and repeat the test until successful. The method of repair shall be approved by the Engineer.
  - 3. The leakage test shall be conducted concurrently with the pressure test. Leakage shall be determined with a calibrated test meter furnished by the Contractor. Leakage is defined as the quantity of water required to maintain a pressure within 5 psi of the specified test pressure, after air has been expelled and the pipe filled with water.
  - 4. Leakage shall not exceed 10 gallons per day per mile per inch of diameter specified. If leakage exceeds the specified limits, the Contractor shall find and repair the leaks and repeat the test until successful.
  - 5. All visible leaks shall be repaired regardless of amount of leakage.



**V-10 AIR RELEASE VALVES**

- A. Air Release Valves shall be A.R.I. Flow Control Accessories Ltd. Model D-023 Combination Air Valve or equivalent approved by the Department of Engineering.
- B. Air Release Valves shall be installed upon the Department of Engineering's approval only. Air Release Valves shall be installed at each significant high point where air could become trapped. The air release valve shall be installed in a manhole structure with provisions made for draining the structure, odor control and for an exhaust pipe. Forcemains shall be designed to minimize the number of air release valves.

**V-11 BUILDING SANITARY SEWER LATERALS**

- A. All building sewers shall conform to the Indiana Plumbing Code.
- B. The building sanitary sewer service lateral shall connect to the public sewer mainline per the Standard Drawings.
- C. Contractor shall obtain all necessary permits needed for work within the Right-of-Way or sanitary sewer easement. Service connections to mainline sewers shall require a permit and tapping fees per the City requirements.
- D. There should be only one service lateral connection per parcel. If any commercial or industrial parcels have more than one building to connect, a sewer main extension is required and shall be approved by the Department of Engineering. Inside drop connections to manholes will not be permitted.
- E. Building sewer service riser installed for future connections shall be terminated at the street right-of-way or easement and shall be properly plugged to ensure a watertight seal.
- F. The minimum allowable inside diameter for building sewer laterals shall be 6 inches with a slope no less than 1/8 inch per foot.
- G. Clean-outs, equal in size to the building sewer lateral shall be required at the following locations:
  - 1. The outside junction of all residential and commercial building drains and the building sewer laterals,
  - 2. For 6 inch service laterals, every 100 linear foot of sanitary sewer lateral piping, and
  - 3. Any Change of direction greater than 45 degrees. Where more than one change of direction occurs in a run of piping, one cleanout shall be required for each change of direction that results in a total deflection of 90 degrees.
- H. All 6 inch service lateral connections shall be installed with a wye fitting. Shielded Fernco fittings shall be used for connection of the wye fitting to existing sewers.
- I. Any service connection servicing more than one building shall be a minimum of 8 inches inside diameter. Manholes shall be used for all 8 inch or larger service lateral connections and at any change in direction.

- J. All sanitary service lateral piping and fittings shall be PVC SDR 35, per ASTM D-3034, with gasketed joints, per ASTM D-3212, unless otherwise indicated. Installation of all PVC sanitary pipes shall conform to ASTM D-2321.
- K. Sanitary Sewer service lateral testing:
  - 1. Building sewer test: The building sewer shall be tested by insertion of a test plug at the point of connection with the public sewer or individual sewage disposal system. The building sewer shall then be filled with water under a head of not less than 10 feet. The water level at the top of the test head of water shall not drop for at least 15 minutes.
  - 2. Air Test: The air test shall be made by attaching an air compressor testing apparatus to an opening, and after closing all other inlets and outlets to the system, forcing air into the system until there is a gauge pressure of 5 pounds per square inch. This pressure shall be held without introduction of additional air for a minimum period of 15 minutes.
  - 3. Sewer Tap Inspection: Call the Mishawaka Sewer Department at least 24 hours before inspection is needed.
- L. A privately maintained sanitary sewer system that may include, but is not limited, to the following: sewer main, manholes, lift stations, force mains, multiple service laterals and connects downstream to the City of Mishawaka's sewer collection system shall require the following:
  - 1. Meet all pipe material requirements as stated in Section V-1 of these specifications.
  - 2. Meet all installation and testing requirements as stated in Section V-2 and V-3 of these specifications.
  - 3. Sanitary manholes shall be installed and tested per sections V-4 and V-5 of these specifications.
  - 4. All design plans shall be signed by a Professional Engineer licensed in the state of Indiana and submitted for approval to the City of Mishawaka Department of Engineering.
- M. Modifications or changes to the above shall be approved by the Department of Engineering.

## V-12 GREASE INTERCEPTORS

- A. Grease Interceptors shall be required for the following types of new building developments, existing buildings with new kitchen additions, existing buildings undergoing a change in ownership/occupancy or any existing building/facility experiencing difficulty achieving compliance with the maintenance and/or wastewater discharge limitations:
  - 1. All non-residential developments involved in food preparation, processing, and service of food or food products.
  - 2. A Multi-family residential development that will, or has the potential to, discharge grease, oil, or similar substances, having a quantity and characteristics above that of a normal family residential waste, to the sanitary sewer.

3. Any development or building that will, or has the potential to, discharge grease, oil, or similar substances, having a quantity and characteristics above that of a normal family residence waste, to the sanitary sewer.
- B. Construction and Installation
1. Installation of all grease interceptor shall be downstream of all kitchen drains or grease-laden equipment drains and dishwashers and in a location readily and easily accessible for cleaning, maintenance and inspection purposes.
  2. Grease interceptors shall be constructed with a minimum of one baffle pipe on both the inlet and outlet sides.
  3. Grease interceptors are to be installed at a minimum distance of 10 feet from sinks and 20 feet from dishwashers to allow for adequate cooling of the wastewater. Water temperatures must be less than 120 degrees Fahrenheit prior to entering the grease interceptor.
  4. Each building or facility shall have a separate individual exterior grease interceptor.
  5. If directed to by the Department of Engineering, a sample port or manhole shall be installed downstream of the grease interceptor. The opening shall be a minimum of 24 inches to allow for sampling access. Refer to Detail V-15 in the Standard Drawings.
  6. All grease interceptors shall have the following:
    - a. A sample port or manhole, if directed.
    - b. Clean-outs on either side of every grease interceptor.
    - c. Manhole(s) at each internal baffle pipe (no more than 10 feet between manholes), no hidden internal baffles.
    - d. A minimum of 9 inches shall be maintained from the liquid level to the grease interceptor top.
    - e. Interior baffle pipe tees shall extend a minimum of 0.15 of the liquid depth above the liquid level.
    - f. Inlet baffle pipe tee shall extend 0.25 of the liquid depth below the liquid level.
    - g. Outlet baffle pipe tee shall extend 0.5 of the liquid depth below the liquid level.
    - h. Manhole access covers over each baffle pipe shall be a minimum 24 inches in diameter. Castings shall be cast iron or equivalent traffic bearing material. All grade rings shall be grouted/sealed. Manholes/covers should extend to the finished grade and shall be water and gas tight.
    - i. Concrete grease interceptors shall have a minimum concrete compressive strength of 3,500 psi. Grease interceptor and castings shall be structurally designed for vehicular traffic with an H-20 Highway load.
  7. Grease interceptors shall be per Detail V-16.
  8. All connections to grease interceptors shall be inspected and approved by the City prior to backfill. The City will require 72 hours notice prior to inspection.

## C. Grease Interceptor Size Requirements

1. Grease interceptors shall be sized based on the following calculations:

Grease Interceptor Sizing Calculations								
Tank Size (in gallons)	=	Meals Served During Peak Hour	X	Waste Flow Rate Factor	X	Retention Time Factor	X	Storage Factor
Meals Served During Peak Hour								
Meals Served During Peak Hour = Seating Capacity x Peak Factor								
a. Peak Factor for Fast Food Restaurants								1.33
b. Peak Factor for all other Food Service Types								1
Waste Flow Rate Factor								
a. Commercial kitchen with dishwashing machine								6
b. Commercial kitchen without dishwashing machine								5
c. Single service kitchen								2
d. Sink waste only								1
Retention Time								
a. Commercial kitchen waste								2.4
b. Single service kitchen								1.5
Storage Factor								
a. Fully equipped commercial kitchen having								
8-hour operation								1
12-hour operation								1.5
16-hour operation								2
24-hour operation								3
b. Single service kitchen								1.5

2. The sizing method described above is intended as guidance in determining the grease interceptor size. It is the responsibility of the property owner and/or contractor to insure that the appropriate size interceptor is installed to meet the level of treatment needed.
3. Refer to the Grease Interceptor Detail, Detail V-16 in the Standard Drawings.
4. Regardless of the above sizing formula, the minimum size grease interceptor shall be no less than 750 gallons total capacity unless otherwise approved by the City.
5. The maximum size of grease interceptors allowed shall be a 3000-gallon capacity tank. If a larger capacity grease interceptor is required then multiple grease interceptors shall be installed in a series. Grease interceptors that are installed in series shall be of similar size.
6. Polyethylene or fiberglass grease interceptors may be allowed, in lieu of an exterior concrete grease interceptor if approved by the City of Mishawaka. Approval shall be based on a request, submitted to the City, that includes calculations, data, drawings, a detailed maintenance plan, designated maintenance supplier and any other information to support the installation and maintenance of the proposed grease interceptor. All polyethylene or fiberglass grease interceptors shall be traffic rated.

**D. Alternative Methods**

1. An exterior concrete grease interceptor, per the size requirements above, is the primary required device unless site or property restrictions or certain circumstances require an alternative procedure. Any establishment that proposes the use of an alternative method for grease containment must submit a request to the City. The submitted proposal request shall include calculations, data, drawings, a detailed maintenance plan, designated maintenance supplier and any other information to support the installation and maintenance of the proposed alternative. A Professional Engineer licensed in the State of Indiana shall design and sign the proposal.
2. The use of an alternative method will only be approved by the City based on the following conditions:
  - a. In the circumstance of a “single service kitchen” with no food preparation (heat/serve only) and the meals are served on disposable plates and utensils, i.e., concessions stands.
  - b. For cases in which exterior type grease interceptors are infeasible to install due to physical property restrictions, including zero-lot line, i.e., downtown areas with existing building structures located at sidewalk or roadway. The alternative, due to physical property restrictions, cannot be used with the construction of a new building where the owner or contractor did not provide a stub and the necessary room for the installation of the appropriate sized exterior grease interceptor.
3. A mechanical grease trap alternative that has already gained approval in the cases noted above may be submitted for approval and shall meet the following:
  - a. Mechanical Grease Trap - The Big Dipper Series or an approved equal with a minimum 50 gallon per minute (gpm) flow rated or a 100 pound grease retention mechanical grease trap may be used. The grease trap shall be installed in a separate area from the food handling area and in a location that is easily accessible for cleaning, maintenance, and inspection. The grease trap shall be downstream of all kitchen drains or grease-laden equipment drains. The maintenance and inspection procedures for a mechanical grease trap shall be the same as that required of a grease interceptor.

**E. Maintenance and Inspection**

1. All property owners or utility users with grease interceptors or grease traps shall have sole responsibility for the maintenance of the grease interceptor or grease trap. They shall be responsible for the proper removal and lawful disposal, by appropriate means, of the captured material in the interceptors.
2. All property owners or utility users with grease interceptors or grease traps shall maintain a written record on site of grease interceptor or grease trap maintenance.

3. Maintenance shall include the complete removal of all contents, including floatable materials, wastewater, sludge and solids.
2. No grease waste shall be discharged directly to the City's wastewater collection system.
3. The City has the right to inspect all grease interceptors and grease traps that are upstream from the City's wastewater collection system at any time. Any person, business or owner that are found to be responsible for the discharging of fats, oils and grease shall be charged for the cost of rectifying any and all issues created by the discharge.

#### V-13 SANITARY SEWER REHABILITATION, CURED IN-PLACE PIPE (CIPP)

- A. Existing sanitary sewers with CIPP rehabilitation, as designated by the City of Mishawaka, shall include design plans and specifications that shall be submitted for approval by the City.
  1. All CIPP products, design, installation and testing shall comply with the latest versions of ASTM D5813, ASTM F1216 and ASTM F1743.

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## SECTION VI - STORM SEWERS

### VI-1 FOOTING DRAINAGE DISCHARGE COLLECTION SYSTEM

A footing drainage discharge collection system shall be designed and installed in all new developments where the seasonal high groundwater is within 4 feet of existing grade.

### VI-2 STORM SEWER PIPE

The following pipe materials may be used for storm sewer installations. For storm sewer installations with the cover exceeding 10 feet, a design shall be completed and signed by a Professional Engineer licensed in the State of Indiana and shall be submitted to the office of the Department of Engineering for review and approval.

#### A. Storm Sewer Pipe

1. Reinforced Concrete Pipe (RCP) meeting the requirements of ASTM C76, Class III, and Wall B each pipe shall be marked with this information. Pipe ends shall have O-ring grooves provided during manufacturing process. Each pipe will be marked with this information.
  - a. Rubber O-ring gaskets and joints of concrete pipe will meet the requirements of ASTM C443.
  - b. Pipe bedding Detail 'A' or 'B' will be required.
  - c. Pipe shall have a smooth wall interior.
2. Ductile Iron Pipe (DI) meeting the requirements of ANSI-AWWA C150/A21.50 and C151/A21.51 pressure classification 350 psi minimum. Each pipe will be marked with this information.
  - a. Joints of the Ductile Iron Pipe will meet ANSI/AWWA C11/A21.11.
  - b. Pipe bedding Detail 'A' or 'B' will be required.
  - c. Pipe shall have a smooth wall interior with cement lining per ANSI/AWWA A21.4/C104
3. Vitrified Clay Pipe (VC) meeting the requirements of ANSI/ASTM C-700 extra strength. Each pipe will be marked with this information. Vitrified clay pipe shall be used only with City approval.
  - a. Joints of vitrified clay pipe will meet the requirements of ANSI/ASTM C425.
  - b. Pipe bedding details 'A' or 'B' will be marked.
  - c. Pipe shall have a smooth wall interior.
4. Polyvinyl Chloride Pipe (PVC), sizes 4 inches through 15 inches in diameter, meeting the requirements of ASTM D3034, SDR 35 and have a minimum pipe stiffness of 46 PSI. PVC pipe larger than 15 inches in diameter, meeting the requirements of ASTM F679. Each pipe will be marked with this information.



- a. The pipe shall be jointed with an integral bell, bell and spigot type rubber gasket joint. Gasket will conform to ASTM D3212 and F477. Fittings will conform to ASTM D3212.
  - b. Pipe bedding Detail 'B' will be required.
  - c. Pipe shall have a smooth wall interior.
  - d. All PVC storm sewer pipe shall be deflection tested. The maximum acceptable pipe deflection after installation is 5 percent of the nominal pipe diameter. The pipe shall be tested by the contractor 30 days or greater after the installation is complete and upon written notification to the City. The deflection test shall be completed with a 9-point mandrel for maximum deflection. The mandrel shall be pulled manually and no force pull on the mandrel will be permitted. The deflection test shall be witnessed and certified by a Professional Engineer and submitted to the office of the Department of Engineering. If the pipe fails the deflection test, the pipe shall be excavated, removed, and discarded. New pipe shall be installed and retested per the above.
  - e. A-2000 PVC pipe shall meet the requirements of ASTM F949. It shall be smooth interior and can be used up to 36 inches in diameter.
5. Smooth-Lined Corrugated Polyvinyl Chloride Pipe (SLCPVC), sizes 4 inches to 30 inches in diameter, meeting the requirements of ASTM F-949. Each pipe will be marked with this information. The pipe stiffness will be a minimum of 46 PSI. The pipe manufacturer will certify compliance with these requirements.
- a. The joint will be water tight with integral factory-formed bell and spigot with a rubber gasket in accordance with ASTM D3212 and F477.
  - b. The gasket on the spigot end of the pipe shall be lubricated prior to insertion as required by the pipe manufacturer.
  - c. Pipe bedding Detail 'B' will be required.
  - d. All SLCPVC storm pipe shall be deflection tested. The maximum acceptable pipe deflection after installation is 5 percent of the nominal pipe diameter. The pipe shall be tested by the contractor 30 days or greater after the installation is complete and upon written notification to the Department of Engineering. The deflection test shall be completed with a 9-point mandrel for maximum deflection. The mandrel shall be pulled manually and no force pull on the mandrel will be permitted. The deflection test shall be witnessed and certified by a Professional Engineer and submitted to the office of the Department of Engineering. If the pipe fails the deflection test, the pipe shall be excavated, removed, and discarded. New pipe shall be installed and retested per the above.

6. Polyvinyl Chloride Pipe meeting the requirements of AWWA C900 (PVC-C900) for pipes 4 inches to 12 inches in diameter and Polyvinyl Chloride Pipe meeting the requirements of AWWA C905 (PVC-C905) for sizes 14 inches through 36 inches in diameter. Each pipe will be marked with this information.
  - a. The pipe shall be jointed with an integral bell, bell and spigot type rubber gasket joint. Gasket shall conform to ASTM F477.
  - b. Pipe bedding Detail 'B' will be required.
  - c. Pipe shall have a smooth wall interior.
  - d. All PVC-C900 and PVC-C905 storm sewer pipe shall be deflection tested. The maximum acceptable pipe deflection after installation is 5 percent of the nominal pipe diameter. The pipe shall be tested by the contractor 30 days or greater after the installation is complete and upon written notification to the City. The deflection test shall be completed with a 9-point mandrel for maximum deflection. The mandrel shall be pulled manually and no force pull on the mandrel will be permitted. The deflection test shall be witnessed and certified by a Professional Engineer and submitted to the office of the Department of Engineering. If the pipe fails the deflection test, the pipe shall be excavated, removed, and discarded. New pipe shall be installed and retested per the above.
- B. Perforated Storm Sewer Pipe (Underdrain)
  1. Smooth-Lined Corrugated Polyethylene Pipe (SLCP), sizes 4 inches through 10 inches in diameter, meeting the requirements of AASHTO M-252, Type S and pipe sizes 12 inches through 36 inches, meeting the requirements of AASHTO M-294, Type S. Each pipe will be marked with this information. Pipe shall only be acceptable for use as a perforated pipe.
    - a. The polyethylene pipe will be produced from resins meeting the requirements of ASTM 3350 with a Cell Class of 324420C. The pipe manufacturer will certify compliance with these requirements.
    - b. The joint will be a self-locking polyethylene integral bell or bell sleeve. It shall be watertight in accordance with ASTM D3212. The rubber gasket shall meet the requirements of ASTM F477.
    - c. The gasket on the spigot end of the pipe shall be lubricated prior to insertion as required by the pipe manufacturer.

- d. All SLCP perforated storm piping shall be deflection tested. The maximum acceptable pipe deflection after installation is 5 percent of the nominal pipe diameter. The pipe shall be tested by the contractor 30 days or greater after the installation is complete and upon written notification to the City. The deflection test shall be completed with a 9-point mandrel for maximum deflection. The mandrel shall be pulled manually and no force pull on the mandrel will be permitted. The deflection test shall be witnessed and certified by a Professional Engineer and submitted to the office of the Department of Engineering. If the pipe fails the deflection test, the pipe shall be excavated, removed, and discarded. New pipe shall be installed and retested per the above.
    - e. Perforated storm sewer piping will not be permitted within a wellhead protection area.
  - 2. High Density Polyethylene Pipe (HDPE) meeting the requirements of AASHTO M294.
    - a. HDPE pipe shall be used only with Engineer's approval prior to bidding.
    - b. It shall be smooth interior and only utilized as perforated pipe up to 36 inches in diameter.
  - 3. Profile Wall PVC Pipe (PWPVC) meeting the requirements of AASHTO M304 and ASTM F794.
    - a. The pipe shall be jointed with an integral bell, bell and spigot type rubber gasket joint. Gasket will conform to ASTM D3212 and F477.
    - b. The gasket on the spigot end of the pipe shall be lubricated prior to insertion as required by the pipe manufacturer.
    - c. All PWPVC perforated storm piping shall be deflection tested. The maximum acceptable pipe deflection after installation is 5 percent of the nominal pipe diameter. The pipe shall be tested by the contractor 30 days or greater after the installation is complete and upon written notification to the City. The deflection test shall be completed with a 9-point mandrel for maximum deflection. The mandrel shall be pulled manually and no force pull on the mandrel will be permitted. The deflection test shall be witnessed and certified by a Professional Engineer and submitted to the office of the Department of Engineering. If the pipe fails the deflection test, the pipe shall be excavated, removed, and discarded. New pipe shall be installed and retested per the above.

C. Storm Sewer Installation

- 1. All storm sewer pipes shall be laid using a laser beam method to control alignment. All sewer pipes shall be laid true to both horizontal and vertical alignment, and will be subject to review by the Department of Engineering. Pipes that do not "Lamp" shall be removed and reinstalled to true line and grade.

2. Commence laying gravity sewer pipe at the lowest point on a section of line and lay pipe with the bell ends uphill.
3. New pipe must match the pipe to which it is being connected. All of the pipes herein permitted shall be connected to a concrete manhole.
4. Prior to making connections at pipe joints and manholes, remove all mud, sand or other foreign material then clean and dry all surfaces of pipe joints and joining material. Use materials as recommended by the manufacturer.
5. Follow the IDEM standards for separation of storm sewer and water distribution systems. A minimum of 18 inches of separation shall be maintained between any sewer pipe and water main utility crossings. If the minimum separation cannot be met then the storm sewer pipe material shall be a pressure grade pipe of ductile iron with mechanical joints or PVC-C900 or PVC-C905 with compression seals. The pipe shall be pressure tested in place at 150 psi without leakage.
6. The installation of storm sewer pipe, within a casing, by jack/bore method shall be per Section VII-2.

#### VI-3 STORM SEWER CASTINGS

- A. Manhole, inlet, and catch basin castings shall be as specified in the Mishawaka Standard Drawings or as approved by the Department of Engineering.
- B. All storm sewer catch basin and inlet castings shall be NPDES Phase II compliant with a permanently cast fish image and “DUMP NO WASTE! DRAINS TO WATERWAYS” message.
- C. All old castings that are removed or replaced during construction shall be turned over to the City.

#### VI-4 STORM SEWER MANHOLES AND INLETS

- A. Manholes, inlets and other storm structures shall be constructed per the Standard Drawings for the type and size shown on the drawings, Details VI-1 thru VI-9.
- B. Manhole frames and lids shall be a Neenah R-1642 or approved equal. Use a Mishawaka Manhole Lid, Detail V-7, if designated by the City. Inlet castings shall be per the Inlet Detail VI-8 or approved equal.
- C. Manholes, inlets and other storm structures shall be precast concrete constructed per ASTM C478 with joints meeting requirements of ASTM C443.

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## SECTION VII - UTILITIES

### VII-1 WATER UTILITIES

- A. Water utilities shall be installed and tested per the “General Construction Specifications” for the Mishawaka Utilities Water Division.

### VII-2 UTILITIES IN CASING (JACK/BORE METHODS)

- A. Materials
  - 1. Carrier pipes used in the crossings shall be the same material as that adjacent to the crossings. The carrier pipe shall be installed per the lines and grades shown on the plans or as directed.
  - 2. The Casing pipe shall be as shown on the plans. Steel casing shall have a minimum thickness as shown in the Pipe in Casing Detail, Detail VII-1, in the Standard Drawings.
  - 3. All utilities installed under a railroad right-of-way shall be in accordance with the specifications and requirements of the railroad having jurisdiction.
- B. Installation
  - 1. The casing pipe shall be so constructed as to prevent leakage of any substance from the casing throughout its length except at the ends of the casing, which must be blocked to prevent the entrance of foreign material. Casing shall be installed to prevent the formation of a waterway under the Pipe, and with an even bearing throughout its length, and shall slope to one end as shown on the plans.
  - 2. The casing pipe shall be pushed into the embankment with jacks and shall have a boring auger rotating within the pipe to remove the spoil. The front of the pipe shall be provided with mechanical arrangements or devices that will prevent the auger and cutting head from leading the pipe by more than 1/2 inch. Under no circumstances will more than 1/2 inch of unsupported excavation be permitted ahead of the casing pipe. The face of the cutting head shall be arranged to provide reasonable obstruction to the free flow of soft or poor material into the casing.
  - 3. The use of water or other liquids to facilitate casing emplacement and spoil removal is prohibited.
  - 4. If an obstruction is encountered during installation to stop the forward action of the pipe, and it is evident that it is impossible to advance the pipe, operations will cease and the casing shall be abandoned in place and completely filled with grout per INDOT Specifications 716.03b.
  - 5. All installations shall have a bored hole essentially the same as the outside diameter of the pipe, plus the thickness of the protective coating. If voids should develop or if the bored hole is greater than the outside diameter of the casing by more than 1 inch, grouting shall be required to fill the voids.

6. When a gravity flow carrier pipe is placed inside the casing pipe, the carrier pipe shall be secured to the lines, slopes, and grades shown on the plans and then the void between the 2 pipes shall be filled with a flowable grout, unless otherwise indicated on the plans, so that the carrier pipe remains in a fixed position.

## **SECTION VIII - MAINTENANCE OF TRAFFIC**

### **VIII-1 STREET SIGNS**

- A. The developer is responsible for Payment to the City of Mishawaka prior to the Installation of All traffic control signing and street name signs on all streets to be dedicated to the City. All traffic control devices are to be in conformance with the MUTCD

### **VIII-2 CONSTRUCTION SIGNAGE**

- A. A Maintenance of Traffic plan must be submitted for City approval at least 5 working days prior to restriction or closure of any street. The plan shall include anticipated date and times of restriction or closure as well as emergency contact numbers. Note: Additional traffic control may be needed for High Volume Streets, as listed in ordinance.
- B. The contractor is responsible for proper traffic control and warning signing and devices as required by the MUTCD, for the duration of construction on any public street. Failure to do so will result in the City providing the necessary equipment and charging the contractor with all related costs.
- C. All Temporary Traffic Control Devices shall be in accordance with the current edition of the “Indiana Manual on Uniform Traffic Control Devices”.
- D. All Temporary Traffic Control Devices shall be delivered to the jobsite in good condition meeting the minimum retroreflectivity levels indicated in Section 2A.08 of the “Indiana Manual on Uniform Traffic Control Devices”.
- E. The Department of Engineering reserves the right to reject any sign, barricade or temporary concrete barrier section that is visually deficient.



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## SECTION IX – TRAFFIC SIGNALS

### IX-1 CONSTRUCTION REQUIREMENTS

- A. The Contractor shall furnish and install all necessary miscellaneous equipment required to make a completed and operating installation of traffic signals in accordance with the plans, specifications, Sections 805 and 922 of the INDOT Standard Specifications, and the INDOT Standard Drawings, except as revised herein.
- B. Traffic Signals shall only be installed by a contractor pre-qualified by INDOT to perform traffic signal installation work.

### IX-2 TRAFFIC SIGNAL EQUIPMENT

- A. CONTROLLER AND CABINET
  - 1. The cabinet shall be a NEMA TS2, Type 1, P-cabinet.
  - 2. The controller and cabinet shall be equipped with the necessary equipment for fiber and/or radio communication and be compatible with existing City of Mishawaka traffic system software.
  - 3. The controller shall meet, as a minimum, all applicable sections of the NEMA Standards Publications for TS2 and NTCIP. The hardware design shall include the following:
    - a. A 16-line by 40-character/line alpha-numeric liquid crystal display (LCD).
    - b. A 10-digit numeric keypad shall also be used to enter vehicle, pedestrian and preemption calls.
    - c. A data key shall be available for use as a database storage device (backup) or as a database transfer module.
  - 4. Required functionality:
    - a. A 100 statement logic processor keyboard programmable that can be used to test ten conditions using AND, OR, NAND, NOR or XOR and to set or clear up to five results if true or five different results if false. These statements shall be enabled, disabled or scheduled on a menu or TOD basis.
    - b. Controller shall include on board support for high resolution data logging (Purdue MOE). This logging shall provide a chronological listing of controller events that can be retrieved by a central system for data analysis and intersection performance measurement.
    - c. Ten preemption sequences that can be programmed as railroad, fire, emergency or bus vehicle preemption sequences.
    - d. Railroad Gate Down allowing track clearance phase to be extended with a programming value called “Gate Down Extension.”

- e. Preempt Exit to Timing Plan shall provide the ability to program a different timing plan to run after preemption. This exit preempt plan will run for one cycle and revert back to the original timing plan that was running prior to preempt.
  - f. An Extendable Walk and Pedestrian Clearance to extend the pedestrian timing until a walk or pedestrian clearance maximum timer expires or the input from a walk extension input is false.
  - g. Adaptive Red Clearance using a separate detector input to sensor if there are still vehicles present after the signal has turned red allowing the red clearance to be extended.
  - h. A Bike Minimum Green used to replace the phase minimum green if the interval time is larger than the minimum green time and if a detector input designated as a bike detector has been activated.
  - i. A Delay Green or Advanced Walk to delay the vehicle movement until the pedestrian movement begins and then delay green times out.
  - j. Four separate timing plans called by coordination pattern, TOD or preemption plan (for 1 cycle following preemption).
  - k. Split and Offset timing in seconds or percentage as selected by the operator.
  - l. A Crossing Arterial Pattern to provide for dual coordination.
  - m. A Local Split Demand shall select a preferred split based on 1 of 2 split demand detector inputs.
  - n. An Adaptive Split Demand where unused time is directed to preference phases unless these phases gapped out the previous cycle.
  - o. Agency Specific Default Database can be programmed and used as backup or transfer to other controllers by use of data key, no computer required.
5. Communication Equipment: each controller shall be provided with a Managed Ethernet switch to support communication with a central system. The supplied hardware shall meet the following minimum specifications:
- a. Operating temperature: -40 Celsius to +75 Celsius.
  - b. Power requirements: 12 to 45 VDC. DC power supply shall be provided with the switch.
  - c. IEEE 802.3 for 10BaseT, 802.3u for 100BaseT(X) and 100BaseFX, 802.3x for Flow control, 802.1D for Spanning Tree Protocol, 802.1w for Rapid STP and 802.1p for Class of Service.
  - d. Plug-n-Play Turbo Run with fast recovery time (under 20 ms).
  - e. Communication protocols: SNMPv1/v2c/v3, DHCP, Server/Client, TFTP, SNTP, SMTP, RARP, RMON, HTTP, Telnet, Syslog.
  - f. Management functions: Turbo Ring, ring coupling, port-based VLAN, QoS, RMON, bandwidth management and port mirroring.
  - g. Support 64 VLANs with an ID range of 1 to 4094.
  - h. Port configuration: four 10/100/1000 base T(X) ports, and five 10/100/1000 base T(X) or 100/1000 base SFP slot combo ports.
  - i. The switch must have the ability for system configuration backup.

- j. Provide 1000 base LX, 10km SFP w/LC connectors as required by plans.
6. All equipment must be approved by the Department of Engineering prior to ordering from manufacturer.

**B. VIDEO DETECTION SYSTEM**

1. Flir SR-Series Fixed-site Thermal Camera Model 334 or next generation video image
2. Array Format (NTSC) 320 x 240
3. Focal Length 13mm, 19mm, 35mm, 50mm, 100mm
4. Field of View: 48x39 degree (SR-348: 9mm), 34 x 28 degrees (SR-334: 13mm)
5. Units shall be IP addressable for system networking from TOC.
6. Interface to signal controller shall be by AutoScope machine video processor (MVP).
7. Wiring Harness: Autoscope Image Sensor Cable, 75 Ohm Video Coax with 16awg, 3 conductors, stranded.
8. All equipment must be approved by the Department of Engineering prior to ordering from the manufacturer.

**C. OPTICAL PREEMPTION TRAFFIC SIGNAL CONTROL SYSTEM**

1. The optical preemption traffic signal control system shall use optical communication technology with encoded data transmissions to verify authorized vehicle actuations of the system.
2. This optical communication technology will work in concert with the local traffic signal controller at the intersection and will request the controller to advance to and/or hold a desired traffic signal display.
3. System shall be 3M Opticom or approved equal.
4. All equipment must be approved by the Department of Engineering prior to ordering from the manufacturer.

**D. BROADBAND WIRELESS SIGNAL INTERCONNECTION**

1. Radio and Dual Radio: Material shall meet these minimum requirements.
  - a. IEEE 802.1d, p, q, w; 802.3ab, ac, ad, I, u, x; 802.11e, h; PoE Standard 802.3af/at compliant
  - b. Security: SSID, AES-CCM, WPA-PSK, WPA2-PSK, WPA-EAP, WPA2-EAP, TKIP, 802.1X, RSN, 128/256 Encryption.
  - c. Enclosure: Dies-Cast Aluminum, IP-67 Weatherproof Rating, External RSSI LEDs and power reset-reboot button.
  - d. Operating temperature range: -45 to 85°C; Humidity: (non-condensing): 5% to 95%.
  - e. Industrial Weatherproof 10/100/1000 Base-TX Ethernet (RJ45) auto negotiation speed Interface; Surge and reverse polarity protection included.

- f. 160' CAT5E or better industrial outdoor rated cable with weatherproof connector; N-type (F) connectors and cable for external antennae when required.
    - g. Selectable Channel Widths: 5, 10, 20, 40MHz and Frequency Range: 5.150 - 5.825GHz supporting a Data Rate of 108Mbps.
    - h. Topology: Point-to-Point, Point-to-Multipoint.
    - i. Geolocation: Embedded GPS module used to map radio location automatically in the radio network management software.
    - j. Provide equipment configuration software with: IP discovery tool, Network Diagnostics, Bandwidth Test Tool, Client Connection Quality (CCQ), Configuration File Management, Real Time RSSI.
  2. Wireless Link Minimum; each wireless link shall have the minimum full-duplex throughput of 10Mbps as demonstrated by a bandwidth test.
  3. Mounting Hardware shall be included with each radio assembly to mount the radio (integrated or dual) and external antenna for dual locations.
  4. Power Supply
    - a. PoE injector shall comply with 802.3 af/at standards
    - b. -40 to +75 C operating temperature range
    - c. DIN Rail mount.
    - d. RJ45 Ports shall support 10/100/1000 Base T(X) for PoE out and Data In.
    - e. Supports maximum power output of 30 Watts at 24/48 VDC.
    - f. AC/DC power supply included if required by location.
- E. SIGNAL HEAD SPECIFICATION
  1. All signal heads shall be polycarbonate and include current Institute of Traffic Engineers (ITE) specified LED inserts for all colors and arrows.
  2. Pedestrian signals shall be aluminum or polycarbonate and include LED inserts with countdown.
  3. ITE specified hand, man, and countdown LED inserts shall be GELcore or approved equal.
- F. UNINTERRUPTIBLE POWER SUPPLY
  1. Unit shall be capable of handling surges and spikes present in normal utility power, provide up to 12 hours battery backup during power outages, and have the capabilities of being remotely monitored.
  2. Unit shall be housed in a separate cabinet and connected/mounted to the side of traffic controller cabinet.
  3. An automatic transfer switch shall be included.
  4. Unit to be model DBL700MX as manufactured by TechPower Developments Inc. or approved equal.
  5. All components must be interchangeable with existing battery units.
  6. All equipment must be approved by the Department of Engineering prior to ordering form manufacturer.

**G. SIGNAL SERVICE**

1. The electric service shall be installed on the side of the controller cabinet, opposite the uninterruptible power supply.
2. The contractor shall obtain a meter base and meter from the City of Mishawaka Utilities, Electric Division, at 1646 East 12<sup>th</sup> Street (574-258-1708).
3. The contractor shall install the meter base, meter (if required to) and disconnect switch, external to the controller cabinet, including service grounding.
4. The electrical disconnect shall have separate switches for the traffic signal and the signal mounted luminaires.
5. The City of Mishawaka Utilities, Electric Division will supply underground electric service for the City's electric controller to the meter base.

**H. HANDHOLES (TRAFFIC/ELECTRICAL)**

1. Handholes shall be constructed per the Standard Detail IX-1.
2. Handhole covers shall display the name of their respective utility (Traffic Signal, Lighting, Fiber Optic). The wording shall be displayed horizontally across the center of the cover. No additional payments will be allowed for the special message on the handhole cover.

**IX-3 SPECIAL TRAFFIC SIGNAL COMPONENT COLOR**

- A. When directed by the City, traffic signal components are to be finished as specified below in an "Architectural Bronze" color. Special care shall be taken by the Contractor to ensure similar colors are used for the different components.
1. Aluminum mast arm poles, mast arms, and appurtenances shall be factory anodized with an "Architectural Bronze" finish.
  2. Steel Strain Poles and appurtenances shall be factory galvanized and powder coated in "Architectural Bronze."
    - a. All components shall be galvanized and finished in accordance with ASTM A 123.
    - b. The powder coating shall be a urethane or triglycidyl isocyanate (TGIC) polyester powder.
    - c. The powder coating shall be applied in accordance with all requirements of the manufacturer of the powder coating material to a minimum dry film thickness of 2 mils (0.002").
  3. Aluminum controller cabinets and other traffic signal appurtenances shall be powder coated "Architectural Bronze."
    - a. The powder coating shall be a urethane or triglycidyl isocyanate (TGIC) polyester powder.
    - b. The powder coating shall be applied in accordance with all requirements of the manufacturer of the powder coating material to a minimum dry film thickness of 2 mils (0.002").

4. Traffic signal heads and pedestrian signals required to be “Architectural Bronze” in color shall be aluminum and powder coated.
  - a. The powder coating shall be a urethane or triglycidyl isocyanate (TGIC) polyester powder.
  - b. The powder coating shall be applied in accordance with all requirements of the manufacturer of the powder coating material to a minimum dry film thickness of 2 mils (0.002”).

#### IX-4 INTERCONNECT CABLE, FIBER OPTIC

- A. The fiber optic cable installation shall be supervised by trained and experienced personnel. The cable terminations shall be done by qualified technicians.
- B. The Fiber Optic installation shall be in accordance with or exceed all minimal requirements of State codes, National codes, and manufacturer codes as applicable.
- C. MATERIALS
  1. Material shall conform to the applicable provisions of Section 805.
  2. The Fiber Optic cable shall be Corning Bend-Insensitive (non-gel filled) Single Mode 12-Strand Cable.
  3. Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products. All materials and equipment furnished shall be new of first quality, of the latest design and be completely free from defects in material and poor workmanship. All like pieces of equipment shall be of the same type and manufacturer to assure uniformity, interchangeability of components, single responsibility, and most satisfactory service.
  4. The single mode fiber optic cable shall contain twelve (12) individually color-coded, buffered, optical fibers around a dielectric central strength member. The multiple ends of non-metallic aramid fibers shall be served in a contra-helical manner, one on top of the other about the center fiber structure to serve as the primary tensile strength elements. The outer covering of the cable shall be black polyethylene extruded over the fiber composite core with a diameter of 0.40 inches.
  5. Fiber Technical Specifications:
    - a. Fiber Type – Silica based, single mode, step index optical wave guides with core/cladding dimensions of 8.3/125 microns, ( $\pm 3.0$  microns).
    - b. Core Ovality – 20 percent Maximum, typically 4 percent.
    - c. Core Eccentricity – 7.5 percent Maximum, typically 4 percent
    - d. Cladding Diameter – 125 microns ( $\pm 2.0$  microns)
    - e. Dispersion – 3.5 ps/nm.km @ 1300 nm, 20.0 ps/nm.km @ 1550 nm.
    - f. Attenuation (max.) – 0.65 dB/km @ 1330 nm maximum
  6. Fiber Optic Connectors shall be of high quality, manufactured by Corning, 3M or approved equal. Connector type such as SC, ST, LC, etc., must be determined in the field. Connector type must be compatible with the design or equipment, switches, modems and interface devices.

7. Connector Technical Specifications:
  - a. Type ST: Loss per Mated Pair -0.5 dB Maximum, 0.3 dB typically
  - b. Type LC: Loss per Mated Pair-0.2 dB Maximum, 0.15 dB typically
  - c. Type SC: Loss per Mated Pair-0.75 dB Maximum, 0.4 dB typically
  - d. Return Loss – 42 dB Typically
8. The fiber optic cable shall be constructed with Kevlar braid and outer polyethylene jackets as a minimum. If an inner jacket is used it shall be PVC. Maximum attenuation of the cable shall be 4.0 dB/Km nominal, measured at room temperature at 1310 nm, and 0.3 dB/Km @ 1550 nm. The bandwidth shall not be less than 160 MHz/Km also at 850 nm. Each fiber shall be continuous with no factory splices except for jointing standard length cables to form longer, continuous jacketed cable to fit installation requirements. The cable shall have standard nylon rip cords or distinctively different color Kevlar rip cords (like red).
9. The cable shall meet the generic requirements for optical fiber and optical fiber cable per Bellcore Technical Reference TR-TSY-000020.
10. Plastic marking tape shall be acid and alkali resistant polyethylene film, 3 inches (77 mm) wide with minimum thickness of 0.004 of an inch (0.102 mm). The tape shall be of a type specifically manufactured for marking and locating underground utilities. Tape color shall be orange and shall bear a continuous printed inscription “CAUTION-FIBER OPTIC CABLE”.
11. The cleaving device shall be a high quality, diamond precision type, capable of cleaving the fiber to within 3 degrees of a perfect flat plane on the end of the glass.

**D. CONSTRUCTION REQUIREMENTS**

1. Where conduit is installed in an open trench, warning tape shall be installed directly above the conduit at a depth of 12 inches below finished grade unless otherwise approved by the Department of Engineering.
2. The Fiber Optic cable shall be installed in continuous runs as indicated on the plans. Splices shall be allowed only in controller cabinets between the ends of the fiber optic interconnect cable and a factory manufactured pigtail assembly. A suitable cable feeder guide shall be used between the cable reel and the face of the duct and conduit to protect the cable and guide it into the duct off the reel. It shall be carefully inspected for jacket defects. If defects are noticed, the pulling operation shall be stopped immediately and the Department of Engineering notified. Precautions shall be taken during installation to prevent the cable from being kinked or crushed. A pulling eye shall be attached to the cable and used to pull the cable through the duct and conduit system. A pulling swivel shall be used to eliminate twisting of the cable. As the cable is played off the reel into the cable feeder guide, it shall be sufficiently lubricated with a type of lubricant recommended by the cable manufacturer. A dynamometer or break away pulling swing shall be used to ensure that the pulling line



tension does not exceed the installation tension value specified by the cable manufacturer. The mechanical stress placed on a cable during installation shall not be such that the cable is twisted or stretched. The pulling of cable shall be hand assisted at each controller cabinet. The cable shall not be crushed, kinked or forced around a sharp corner. If a lubricant is used it shall be of water based type and approved by the cable manufacturer. Sufficient slack shall be left at each end of the cable to allow proper cable termination. There shall be a minimum of 30 feet of slack at every handhole. There shall be a minimum of 50 feet at the top of each rise for aerial spans when using dielectric cable, or after the support cable is stripped out when figure 8 cable is used.

3. For storage of additional slack cable adjacent to conduit riser the contractor shall use Fiber Optic Strand Storage Unit to store and protect the fiber optics at the top of the risers. The support cable shall be terminated at the riser wood pole.
4. Storage of additional slack cable in handholes shall be coiled. The slack coils shall be bound at a minimum of 3 points around the coil perimeter and supported in their static storage positions. Storage of additional slack cable adjacent to conduit risers and support poles shall be as detailed on the following page. At each controller cabinet and handhole the cable shall be visible marked/tagged as “CAUTION-FIBER OPTIC CABLE”. Maximum length of cable pulling tensions shall not exceed the cable manufacturer’s recommendations.
5. At each handhole and cabinet, the fiber optic cable shall be painted for a length of 12 inches (305 mm) with 2 coats of long lasting and highly visible paint. The color shall be unique to each roadway as approved by the Department of Engineering. For example, the cable for the major east-west street may be painted red, the cable for the major north-south street may be painted yellow, and the cable for the minor east-west street may be painted blue.
6. For static storage, the cable shall not be bent at any location to less than 10 times the diameter of the cable outside diameter or as recommended by the manufacturer. During installation, the cable shall not be bent at any location to less than 20 times the diameter of the cable outside diameter or as recommended by the manufacturer.
7. Prior to the installation of the cable, the manufacturer shall submit to the Contractor a factory-performed Optical Time Domain Reflectometer (OTDR) trace result for each reel of cable. The Contractor shall in turn submit the trace results to the Department of Engineering for approval. The Department of Engineering shall inspect the test results for any unacceptable results. Any unacceptable reels shall be replaced with no additional payment.

8. The Contractor shall test each fiber in each full reel from the factor using an OTDR to assure factory ODTR tests are accurate and to verify the cable was not damaged in shipment. After the fiber optic cable has been installed, a post installation test of every fiber in every system link shall be tested using an OTDR, to verify the cable was not damaged during installation. Upon approval of these OTDR traces, fiber may be spliced and/or terminated. A final OTDR test on every fiber in every system link shall be performed after all splicing and connector zing is complete to verify all losses are within budget. Each OTDR test will be performed both directions on every fiber. OTDR testing must be conducted under the direct supervision of a technician with current INDOT Class II Signal Technician Certification. All Power Light Meter and OTDR testing for single mode fiber shall be performed at the wavelengths of 1310 nm and 1550 nm.
9. All splices shall be completed by a technician with current certification as required by the Corning manufacturer's warranty.
10. After all splicing and all OTDR testing is complete, each system link will be tested using a Power Light Meter. All fiber links will be tested from both ends of the link and an average loss will be calculated.
11. A Point to Point Reference shall be documented during the cable pulling process. This will accurately define the length of each cable installed. The meter mark or foot markings on the outside of the cable jacket will be recorded as cable is installed. At a minimum, each of these locations will be documented:
  - a. Cable end at controller cabinet
  - b. Entry/exit conduit at each cabinet
  - c. Entry mark at every handhole
  - d. Exit mark at every handhole
  - e. Bottom of pole riser
  - f. Pole attachments
  - g. Center of Bridges, railroads or other landmarks
12. Cable terminations shall be made using the method recommended by the connector manufacturer. If breakout kits are used, they shall terminate each fiber in the controller cabinet using Kevlar reinforced 3 millimeter buffer tubing.
13. All splicing shall be done by fusion splicing using the light injection detection method. All fusion splice losses will be no larger than a 0.05 dB loss. All splice losses shall be recorded and submitted.
14. Contract Documentation shall include:
  - a. Factory ODTR tests
  - b. Pre-installation full reel OTDR tests
  - c. Post-installation OTDR tests
  - d. Final OTDR tests after splicing is complete
  - e. Power light meter test results
  - f. Point to point references for all fiber optic cables installed
  - g. Fusion splice loss summary

## IX-5 ITS VIDEO SYSTEM

- A. The Contractor shall furnish all necessary equipment, labor and materials required to complete the ITS Video System as shown on the plans. All materials shall conform to the City of Mishawaka Standard Specifications, Section IX-Traffic Engineering. The Contractor shall furnish and install the traffic Pan – Tilt – Zoom (PTZ) Vicon IP camera model VIC-SVFT-PRS35 with V4IP module or approved equal as shown on the plans.
- B. The following features are required:
  - 1. 5.9 “ acrylic bubble, auto flip dome rotation
  - 2. RJ-45 data port
  - 3. auto focus, high-resolution integrated low light color camera
  - 4. Multilanguage on-screen menus
  - 5. on-screen compass and tilt display
  - 6. integral auto-sensing multi-protocol receiver/driver
  - 7. quick disconnect dome drive
  - 8. one pattern
  - 9. 16 x optical zoom and 8 x digital zoom (128 total)
  - 10. Built-in power line surge and limited lightening protection
  - 11. Third party modules
  - 12. zone blanking
  - 13. Switch box for controlling the Pelco and Vicon PTZ camera through Vicon software from multiple work station keyboards.
  - 14. acrylic bubble capable of being Nitrogen filled upon delivery to the job site
- C. Software upgrades for ViconNet, Aries, Centrex, and Autoscope will be required as directed. The IP address shall be assigned at the time of software upgrade and installation.
- D. The camera shall be mounted on a 50 feet tall steel strain pole located as generally indicated in the plans. Before installation of the pole, the Contractor shall furnish the equipment to raise an observer to planned location, so that the location selected is the most advantageous placement within the intersection area. This may result in the pole and camera being located differently than shown on the plans. The acrylic bubble camera enclosure shall be filled with Nitrogen prior to operation.

**SECTION X – LIGHTING/ELECTRICAL****X-1 CONSTRUCTION REQUIREMENTS**

- A. The Contractor shall furnish and install all necessary miscellaneous equipment required to make a completed and operating installation of the lighting system in accordance with the plans, specifications, and accepted good practice of the industry.
- B. All lighting equipment shall be in accordance with the City of Mishawaka Standard Specifications.
- C. **HANDHOLES (TRAFFIC/ELECTRICAL)**
  - 1. Handholes shall be constructed per the Standard Detail IX-1.
  - 2. Handhole covers shall display the name of their respective utility (Traffic Signal, Lighting, Fiber Optic). The wording shall be displayed horizontally across the center of the cover. No additional payments will be allowed for the special message on the handhole cover.

END OF STANDARD SPECIFICATIONS

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